Existing Networking Infrastructure Initiatives of Participating Institutions and Agencies

A secure, reliable, and robust statewide communications network is an infrastructure element required for the success of New Mexico education, government, and economic development. The CHECS Education Technology Consortium (CHECS ETC), in which the primary networking infrastructure providers also collaborate, addresses the computing and communication issues associated with higher education including health sciences and telemedicine applications; it works increasingly with the New Mexico Office of the CIO, NM Generals Services Division, and other state agencies to effectively leverage strategic communications resources like the NM digital network. CHECS-Net provides statewide intranet and network services to educational institutions in the state. Its higher level services deliver greater value at lower costs than the member institutions can obtain on their own. Services provided include bulk connectivity pricing, NOC support, and access to research networking (i.e., **12,** Lambda Rail).

Currently, UNM is on the Board of the National Lambda Rail high-speed research network, and CHECS-Net operates a high-speed connection to I2 Abilene research network in partnership with Los Alamos National Laboratory. CHECS-Net was one of the first sponsored educational groups to join Internet 2.

Key goals and strategies of CHECS ETC and CHECS-Net are to:

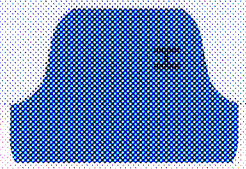
- Provide creative solutions for last mile connectivity issues. One of New Mexico's biggest challenges is the availability of affordable high-speed communication services. When limited to dial-up connections, people must spend valuable time accomplishing tasks that high-speed Internet users can do in seconds, such as downloading a PDF or sending a photograph. Limited dial-up connections make sending radiological images and other large graphic files impossible. With slow Internet connections, even simple tasks can be difficult to complete. Without reliable access to broadband in rural areas, e-services will be unavailable where the need is greatest. The major issue is the lack of last mile connectivity. One solution may involve innovative partnerships with local governments, carriers, or others. Nonetheless, the most appropriate connection technologies for the given area of the state must be selected. Factors in these decisions include cost, reliability, and support infrastructures.
- Construct strong partnerships to build a robust statewide network and coordinate resources through universities and other state agencies.
- Work with the State CIO, the Public Education Department, and the Higher Education Department to align strategies and leverage investments.
- Jointly negotiate with vendors and develop better procurement mechanisms for shared infrastructure.
- Share connectivity to high-speed research networks, including NLR and **12.** Over time, these networks will not only serve educational/research institutions, but facilitate economic development. Optical networks will become an essential part of the networks, since capacity is dramatically increased to benefit areas such as telemedicine.
- Promote New Mexico's networking infrastructure needs by providing coordinated services to member institutions and by providing seamless access to networking technologies that support statewide educational networking.

- Provide a variety of services in response to constituent requirements. Services include technical support, connectivity consultation, network monitoring and analysis, network quality of service, and centralized media technologies support

The State of New Mexico has a significant challenge. It ranks **45th** in per capita income, resulting in significant resource constraints, and it is geographically large, but sparsely populated, with a limited telecommunications infrastructure. To cope with these demographic and economic challenges, it is imperative that partnerships be established to foster improvement within the state network.

An example of a partnership strengthened through CHECS is the Rio Grande Corridor Fiber Project. The money for the long-term lease of the fiber was provided by NMSU and NMIMT, and the Dense Wave Division Multiplexing equipment was provided by New Mexico GSD. This collaboration provides a 100 gigabit layer, one network with different layers, and three networks for various business applications from Santa Fe to El Paso.

Another collaborative partner is the NM Department of Transportation (NMDOT), which has right-of-way access across much of the state. NMDOT needs a communication infrastructure for dynamic message signs, weather sensing, and traffic measurements. With these partnerships, parties can align their needs and leverage their resources to reduce costs.



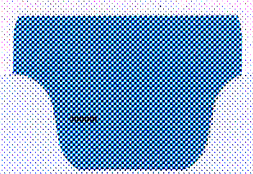
TAG Network Modeling

One goal of this proposal is to develop a general approach for analysis and design of secure, reliable networks with a given functionality applicable to local as well as national size networks for disaster relief. This goal is very hard to achieve without detailed analysis of different network architectures as well as modeling and simulations of appropriate real life scenarios.

Working in conjunction and in parallel with the Network Design Team will be a subteam responsible for creating a model of the network design. This team will consist of UNM Center for High Performance Computing and UNM Electrical and Computer Engineering in consultation with Los Alamos National Laboratory (LANL). The goals of network modeling are to:

- Provide feedback to the network design group for year 2.
- Simulate the effects on the network of major disaster scenarios:
  - Pandemic flu
  - Large forest fire
  - Severe earthquake
- Provide redundancy and support surge capacity recommendations based on simulation results.
- Provide a model that incorporates the Layer 1, 2 and 3 aspects of the network to be able to model the effectiveness of QoS, load balancing, routing protocols and MPLS during disaster scenario.
- Provide simulation using different redundancy techniques and connection modalities.(i.e. wireless, microwave, satellite, free space optics.. ….)
- Produce generalized network modeling techniques that could be applied to any national, regional or global network.

Los Alamos National Laboratory (LANL) will assist and collaborate with the network modeling team, adding extensive experience with large-scale simulations. In recent years, this experience has been applied to national security problems including large-scale pandemics, analysis of the national energy grid, and terrorist threats. In these examples a large number of units are interconnected in a network that evolves in time. Agent-based models have been indispensable for understanding the dynamics of these networks. Please see Appendix C for details about this methodology.



TAG Network Engineering Plan

Network Components and Security Implementation

The proposed TAG network will ultimately provide the capability to enable secure telemedicine communications with an appropriate QoS level per application between regional network participants through their dedicated regional networks as well as Internet 2/NLR. The ability to implement QoS along with secure communications through a national healthcare network backbone is critical to the future development of telemedicine services, both for routine telemedicine operations and for disaster response using telemedicine technologies. The TAG network will be comprised of many different autonomous networks linking via a common core backbone at its inception. A standards based approach to networking is critical to achieving interoperability amongst TAG networks and national healthcare partners. The use of standard encryption technologies combined with the capability to enforce different qualities of service for data flowing across encrypted channels, at local, regional and national backbone levels, is key to and facilitative of widespread acceptance, success and utilization of inter-organizational real-time telemedicine interactions and of inter-organizational electronic health record information exchanges, radiology and video teleconferencing.

There are three components of the disaster response network, and each of them has different security requirements. The first is the network itself, that is, the "layer one" connectivity between the health services locations. "Layer one" consists of leased circuits and owned networks. For this proposal, we will assume that the network will consist of insecure, disparate networks meaning that we cannot, and should not, enforce complex security protocol at this level. Not enforcing "layer one" security allows the greatest flexibility in connecting telehealth applications to the network with minimal effort.

The next component is the interconnectivity between the sites, for example, multipoint video services, radiology images and widespread database sharing. In these cases, security may or may not be required, but if it is, we propose to use available security protocols and technologies. The network design should supply the needed security requirements and specifications.

Finally, there is the application level of the network. This would include applications that are shared between two or more sites that provide a specific function, for example map sharing, private point-to-point video communication, or transmission of sensitive data. In these cases, we would again use currently available technologies for authentication, authorization and encryption. At this level, stricter auditing would be needed because classified information could most likely be transmitted at this level. Again, the network design should supply the needed security requirements and specifications.

Standards-based encryption methodologies, such as advanced encryption standards (AES), will be used to secure data transmissions over networks. The specific implementations of encryption will vary somewhat depending on if the encryption is handled at the application or network level.

Security Issues with the Rio Grande Optical Network

There are two basic areas of concern in the network security. One is the issue of ensuring the network infrastructure is secure. The other concern is the integrity of the data.

The network itself is a system of fiber optic cables and devices that transmit the data. Physical and logical access to these facilities is limited to a need-to-know basis. Termination occurs in secured buildings. All major aggregation points have 24x7x365 security staff deployed. All data equipment access is limited to the secure methods of access and known personnel. This is up to or beyond the standards of commercial carriers.

As for data integrity the cooperative nature of the participants in the Rio Grande Optical Network (RGON) provides an added natural layer of security. The participants are known to each other and related by mutual business purposes. Access to this network is only allowed through the secured networks of the participants.

In traditional networking, the responsibility for data integrity lies with those organizations that send and receive the data. Commercial carriers do not provide additional security without special contractual agreements and associated costs. For example, during natural disasters voice and data systems are jammed with citizens attempting to determine information about the disaster. If in the event of a disaster the University of New Mexico sends critical data to the local first responders through a commercial carrier, that data has no sense of priority. In the RGON network, the cooperative nature of the participants allows for prioritization that better serves the public as a whole.

Since most termination points exist on State of New Mexico property, the participants have the option of installing security monitoring devices that would not be possible with commercial networking. This means that encryption verification and intrusion detection can occur at the most efficient point in the traffic flow. One way to understand the impact that information security can have is to think of a computer virus epidemic as a tsunami. In commercial networking, the tsunami rages over commercially carried Internet and is blocked at the firewall that is at the doorstep of the customer. This may prevent common viral or denial of service attacks from entering the customer network. However, service is normally slowed to a crawl until the huge wave of traffic subsides. This doesn't occur until the source of the intrusion is brought under control. In the private RGON network, security monitoring systems can stop the intrusion at the point of ingress or egress.

Since UNM already operates a network operating center, extending the monitoring and encryption verification can be done without needing additional staff and or infrastructure. Some enhancements of the current systems will be required. The network features Multi-protocol Label Switching (MPLS), which allows the private network of any participant to extend to any geographical point on the network without compromising the level of security normally associated with an isolated facility.

Participants in the RGON network are familiar with confidentiality issues. They deal with the regulation of financial practice outlined in Sarbanes Oxley and used by the Social Security Administration, the Internal Revenue Service, and others. Nearly every participant deals with the Health Information and Portability Act (HIPAA) on some level. Many law enforcement organizations that will benefit from this network must comply with the requirements of federal rules regulations for high density drug trafficking areas (HIDTA).

All these organizations currently enforce their own local security and then send the data over unsecured public accessed networks. Commercial carriers in New Mexico send data to hub locations in other states. Senders use encryption to ensure that the information will not be viewed on its journey to the destination. **All** these organizations hope that commercial carriers will somehow get their critical information to its destination in the event of a disaster, even though there is no prioritization of data on the public Internet. The RGON network ensures high speed data transfer on a network that can verify encryption, prioritize critical data, and better serve the tax payer.

Telehealth Alliances/Telehealth Provider Goals and Objectives

Through our experiences, successes, and lessons learned, we have developed approaches to overcoming barriers to adoption and sustainment of telehealth applications, including the establishment of partnerships with New Mexico and regional telehealth providers and alliances, as well as, economic development projects in our state. Many of these hands-on experiences are applicable to other rural telehealth programs and should be considered in strategic planning, implementation and maintenance, particularly during times of high demand and need for health services for the underserved within a complex, dynamically changing and challenging environment.

Telehealth alliances are maturing in a manner that provides a platform for collaboration: forming public-private partnerships, sharing resources, and developing an interoperable "network of networks." Although telehealth offers the promise to improve access to critical healthcare services and positively impact economic development in rural communities, the vast diversity of populations and the wide spectrum of our healthcare delivery system demand partnerships of many stakeholders in order to effectively and efficiently use telehealth technologies and achieve sustainability. Developing partnerships with key stakeholders can provide a network of networks that preserves individual organizational autonomy but, at the same time,

1) Provides a framework for mutually beneficial collaboration,
2) Develops standards for interoperability and operations,
3) Shares experiences and technical or clinical expertise,
4) Establishes best practices and recommends common guidelines for telehealth program decision making,
5) Addresses issues that impact the entire network operations and its sustainability,
6) Serves as an intrastate, interstate and international point of contact, as well as
7) Facilitates meeting specific participating organization requirements for well-defined needs and provides access to services delivered by recognized centers of excellence.

Finally, regional alliances assist in coordinating state and federal resources or grants for telehealth in a manner that best meets the needs of stakeholders, avoids unnecessary duplication, strengthens the opportunities to obtain and maintain those resources, and facilitates their **use** effectively and efficiently. Regional alliances include the Four Comers Telehealth Consortium — New Mexico, Arizona, Colorado, and Utah, which has been in existence for several years and provides innovative telehealth services and research to that remote portion of the country.

Telehealth Provider Goals and Objectives

1. The Center for Disaster Medicine will expand available networks to allow for connectivity to a broader audience of learners. Because the CDM participates in emergency planning and event response through many of internal programs, it would explore the utility of an expanded and formalized telehealth network that could be relied upon as part of a redundant communication system during a disaster or large public health emergency. The project would go forward with the full collaboration of the New Mexico Department of Health, the New Mexico Hospitals and Health Systems Association, the New Mexico Primary Care Association, and the EMS regional offices.

2. The SW Indian Health Service collaborative's goal is to create a network-to-network connection among healthcare teams and rural Indian communities has been costly or difficult to implement. Although the Indian Health Services for Albuquerque, Navajo, Phoenix, and Tucson Areas have access to some regional telehealth specialists, inadequate connectivity between regional telecommunication networks has hampered the ability to deliver telemedicine clinical and educational services. If funded, secure I2 access for both telemedicine service providers and regional Indian healthcare teams will result in expanded regional use of existing telemedicine services while permitting growth of healthcare delivery in the region. **A** multistate telemedicine service menu will enable Indian health teams in Arizona, Nevada, New Mexico, and Utah to locate service providers for telemedicine service delivery who are appropriate to each team's needs, existing referral patterns, and budgets. A second "fail-over'' point of access to I2 from the IHS **WAN** in Rockville, MD, will be established in year 2 to enable expansion of telemedicine service delivery to Indian health facilities outside the southwest IHS Areas.

3. The Navajo Area IHS (NAIHS) program goals with respect to the FCC Rural Healthcare Pilot Program are to upgrade its existing wide area network infrastructure to enable increased security and redundancy of telemedicine communication via a mesh topology and to implement modem quality of service technologies critical to telemedicine communications. By implementing modern telecommunications carrier class network backbone technologies, NAIHS will be well positioned to interoperate with regional network partners via national high-speed backbone networks such as I2 and NLR. NAIHS plans to create a high speed platform with I2 as the backbone for telemedicine (x-ray reads, x-ray consults, and head trauma); reduce contract health service costs to minimize potential relocation of patients outside the NAIHS service area; and enable increased security and redundancy of telemedicine communications by creating a Mesh WAN topology capable of disaster recovery and resilience; install carrier class router at NAO with security bundle feature, and ISR routers and LAN switching fabric at service units, health centers and health stations.

4. The Albuquerque Area IHS Office is to connect to I2 along with the Indian Health Service Navajo, Phoenix, and Tucson Areas. This means upgrading our current routers to ensure a secure and reliable device that can support the various types of protocols required for connecting to I2. The outcome will provide an avenue to expand our telehealth services in a secure and efficient manner to our Business Partners, and it will present the opportunity for our remote locations to access

health, technical and administrative support services.

5. The Arizona Telemedicine Program plans to upgrade its existing wide area network infrastructure to enable increased security of telemedicine communications and to implement modem quality of service technologies critical to telemedicine communications. By implementing modern telecommunications carrier class network backbone technologies, ATP will be well positioned to interoperate with regional network partners via national high-speed backbone networks such as Internet2 or NLR. ATP plans to use its existing connectivity to I2 through the University of Arizona to link with regional or national peers to enable telemedicine services and research. As part of TAG, ATP will collaborate, via I2/NLR and potentially other networks, with other TAG participants in the modeling, testing and deployment of network communications architectures and services tailored for optimal use of telemedicine communications during times of disaster or emergency.

   ATP, through funding granted to University Medical Center by Blue Cross and Blue Shield of Arizona, currently has 2 operational spoke sites, Southeast Arizona Medical Center, and Copper Queen Hospital, and 1 operational hub site, University Medical Center in Tucson, utilizing telemedicine technologies to provide trauma care. Real-time video connectivity and real-time vital sign monitoring of trauma patients in the rural communities of Douglas and Bisbee, Arizona now provides a critical link for these communities to access trauma specialist care on a 24x7x365 basis. Both of these communities qualify for and are enrolled in the current USF Rural Healthcare program for their leased line connections that are used to facilitate this care. ATP will be enabling 3 additional sites in Sierra Vista, Benson, and Nogales, Arizona by June 2007, and another 4 sites are planned to come online later this year. In addition, ATP, through funding granted to the Arizona Department of Health Services, is working with that department and the Arizona Bum Center to establish 24x7x365 access via telemedicine to bum specialists at the Arizona Bum Center for 11 separate hospital ERs this year. The development of these additional 24x7x365 critical care services, adding to a longstanding 24x7x365 teleradiology capability available to ATP members, is directly in line with the goals of the FCC pilot program. FCC pilot program funding will enhance ATP's capability to enable these types of services at additional network member locations, both existing and new. FCC pilot program funding will also be key to ATP's ability to build appropriate levels of network redundancy in the future for all critical care services.

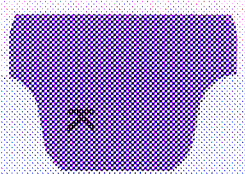
   It is critical that these types of vital critical care capabilities be developed at state and regional levels as operational service offerings to establish a base of service providers experienced at delivering critical care services via telemedicine technologies on a 24x7x365 basis. Establishing this base of service providers within a state or region is critical to being able to effectively deliver a coordinated disaster response via telemedicine, as disasters can strike at any time.

6. The Sangre de Cristo Community Health Partnership (SDCCHP) has a well-established network of behavioral health providers integrated within 35 healthcare facilities and maintains 20 telehealth sites across the state of New Mexico. Funding would allow SDCCHP to increase access to, and quality delivery of, substance abuse and mental health screening, intervention, treatment and referral services to rural areas. While maintaining its current infrastructure, SDCCHP would expand best clinical practice services to additional areas of the state and eventually create a statewide system for substance abuse and mental health prevention, intervention, and treatment; provide clinical supervision of the SBIRT Behavioral Health Counselors (BHC); conduct psychiatric patient clinical consultations, and provide continuing professional clinical education to BHCs and partner site clinical providers and staff.

7. Presbyterian Medical Services (PMS) will link its network to external providers and networks. External networks include the NM Telehealth Alliance, Project Echo, Project Reach, and Emergency Response teams. PMS will also connect all clinical and Head Start sites to a backbone network with sufficient bandwidth to support telehealth, emergency response, educational and certification programs. Our goals include upgrading bandwidth and network throughput, implementing network monitoring, intrusion detection, and implementing highly secure network access points and protocols to ensure compliance with best practices, HIPAA, and other applicable regulations.

8. Holy Cross Hospital will upgrade its existing network infrastructure to implement modem quality of service technologies critical to telemedicine communications and enable increased security of these communications. By implementing modern telecommunications carrier class network backbone technologies, HCH will be well positioned to interoperate with regional network partners via national high-speed backbone networks to connect all HCH clinical sites to a backbone network with sufficient bandwidth, to support telehealth, emergency response, educational and certification programs, link HCH's network to external providers and networks, and upgrade bandwidth and network throughput.

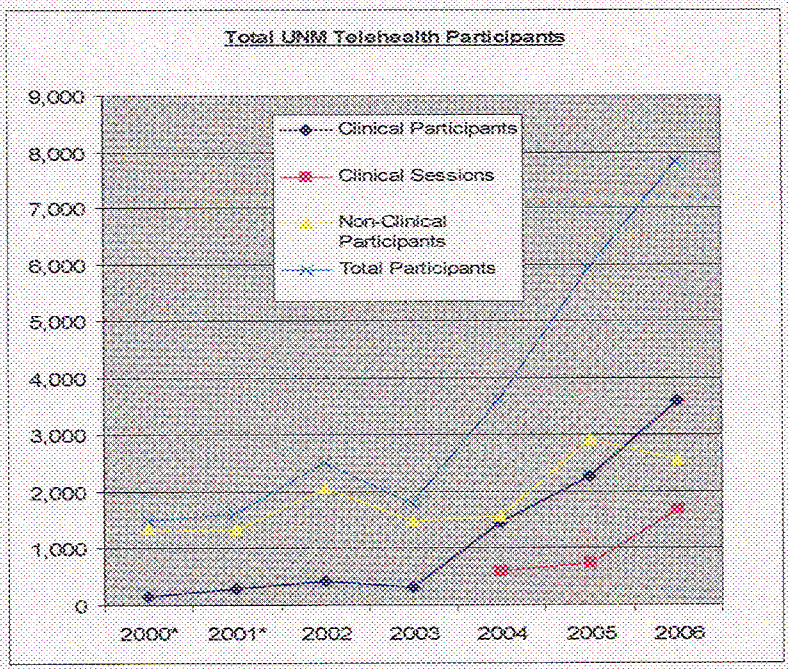
9. UNM Carrie Tingly Hospital will establish 10 new telemedicine links over a two-year period to deliver behavioral medicine services to children and youth in rural areas. Pediatric Behavioral Medicine services are sorely lacking in rural areas in the state of New Mexico. Funding of the TAG network will allow UNM to assess the barriers to establishing links and provide solutions for overcoming these barriers as well as evaluate the use of telemedicine among healthcare providers in these rural areas.



Experience Developing and Managing Telemedicine Programs

Now in its 12th year of operation, the **UNM Center for Telehealth (CTTH) and Cybermedicine Research** has increased the number of clinical services, educational programs and administrative activities delivered to rural New Mexico via telemedicine. Over this time period, the use and interest in telehealth technology has increased dramatically, reflecting a widespread acceptance of its value. Sixteen health science center (HSC) departments used teleconference equipment to access sites throughout New Mexico, the United States, and the world. In Fiscal Year 2005-06, 7,698 people participated in telehealth conferences. The UNM HSC conducted a total of 1,670 clinical telehealth sessions, which is a 129% increase from the previous fiscal year. Of these sessions, 128 were direct patient encounters and 1,542 were case reviews.

UNM HSC Telehealth Usage 2000 - 2006								
Category	Fiscal Year Ending							Total
	2000*	2001*	2002	2003	2004	2005	2006	7 year Totals
Clinical Participants	157	283	436	313	1,462	2,274	3,596	8,499
Clinical Sessions					600	730	1,678	3,000
Non-Clinical Participants	1,348	1,331	2,075	1,492	1,582	2,924	2,550	13,206
Total Participants	1,505	1,614	2,511	1,805	3,644	5,928	7,824	24,705



* Data includes best estimate of videophone use by patient/ non-patient participants, a time period when that specific information was not collected.

In FY 2006, the Center for Telehealth used two technology platforms (interactive televideo and videophone) to deliver telemedicine services to 27 communities in 21 **of** New Mexico's 33 counties. The Center provided consultation or training to **31** UNM departments, programs, and outside organizations and agencies. Over 21 UNM Health Sciences Center departments or programs were able to extend their services to remote areas of the state using telemedicine. Clinical services delivered in FY 2005 include adult and child psychiatric consults, pediatric behavioral medicine, nutritional consults, early childhood developmental evaluations; autism consults, occupational therapy, physical therapy, speech and language pathology consults; substance abuse screening and counseling, and pediatric cardiology, pediatric neurology, and Hepatitis C case consults.

Since its beginning, CfTH has been instrumental in laying the groundwork for developing a statewide telehealth network through pioneering efforts. In 2001, CfTH realized it would not he possible to develop a comprehensive statewide telehealth network using its own resources; other healthcare organizations and stakeholders were reluctant to do business exclusively with the UNM HSC and wanted to develop their own systems using internal resources. Barriers to collaboration related to stakeholder perceptions around relinquishing control and not having individual needs met, particularly in the current competitive healthcare market. Dr. Dale Alverson began discussions with other organizations outside UNM, which resulted in the formation of the New Mexico Telehealth Alliance. This non-profit organization became the "neutral territory" for developing public-private and community partnerships. Its inception created a partnership with key stakeholders to provide a "network of networks" that preserves individual organizational autonomy, avoids unnecessary redundancy, and creates an economy of scale. Please see.

UNM Center for Disaster Medicine

The UNM Center for Disaster Medicine (CDM) is headed by Dr. Michael Richards, an emergency physician and associate professor in the UNM School of Medicine. Additional staff include professionals in the fields of emergency medicine, emergency nursing, community planning, emergency preparedness law, veterinary medicine, disaster medicine, and public health. The CDM supports community disaster preparedness through applied disaster research, healthcare disaster planning, emergency preparedness training for responders, and disaster field services. Faculty members provide medical direction for the Emergency Medical Services Bureau and the Bioterrorism Hospital Preparedness Program for the New Mexico Department of Health (DOH). Through this relationship with DOH, the CDM has participated in the development of the New Mexico Modular Emergency Medical System (NM-MEMS) and advanced the adoption of this framework throughout the state via educational presentations to healthcare and community leaders and strategic planning sessions.

The CDM has a long history of response to medical disasters. It sponsors one of the most active disaster medical assistance teams (NM-DMAT-1) in the National Disaster Medicine System with 19 major deployments since 1989. Team deployments include Hurricane Hugo in 1989, the Northridge Earthquake in 1994, the World Trade Center terrorist attack in 2001, and Hurricanes Katrina and Rita in 2005. CDM also provides the medical direction and pharmaceutical support for the New Mexico Urban Search and Rescue Taskforce and sponsors the Albuquerque Medical Reserve Corps.

SW Indian Health Service Consortium: Albuquerque, Navajo, Phoenix, Tucson Areas

Many Indian Health Service (IHS) and Tribal facilities in the four participating IHS Areas are very experienced with telemedicine. Facilities in Arizona, New Mexico, Nevada, and Utah report growing experience in telemedicine clinical services, distance learning, and administrative program planning via videoconferencing. Noteworthy uses of telemedicine to date include radiology, dermatology, retinal screening, cardiology, and mental health as well as other types of telemedicine modalities.

Through the existing FCC Rural Health Program administered by the Universal Service Administration Corporation, the IHS Albuquerque, Navajo, Phoenix, and Tucson Areas have made significant investments and improvements in telecommunication infrastructure. Such regional Indian health network "build-outs" to many rural Indian health communities in the region make the Southwest IHS Areas ideal partners for a regional, multistate project utilizing the network-to-network connectivity of I2.

The Albuquerque, Navajo, Phoenix, and Tucson IHS Areas provide ongoing technical and administrative support for infrastructure development related to telemedicine clinical services, distance learning, and program planning via videoconferencing. A regional Telehealth Access Grid will significantly enable Indian Health Service providers in New Mexico, Arizona, Nevada, Utah, and Colorado to identify specialists experienced in telemedicine service delivery and effectively connect communities in need with vital specialist resources.

The Navajo Area Indian Health Service

The Navajo Area Indian Health Service (NAIHS) has experience with developing and managing telemedicine program partnerships and collaborations with the Arizona Telemedicine Program (ATP), the Regents of the University of New Mexico, for its public operation known as the Health Sciences Center, School of Medicine, Department of Neurosurgery and University Hospital (UNMHSC), and "Internet to the Hogan" proof of concept in bringing connectivity to the most remote areas on the Navajo Nation. (This was demonstrated at Shiprock, New Mexico.)

These partnerships and collaborations involve Memorandum of Understanding (MOU), Memorandum of Agreement (MOA), FISMA Clearance, Non-disclosure, Interconnection Service Agreement (ISA), Section 508 Compliance, and Business Partner Agreement (BPA). These partnerships and collaborations have involved the following WAN / LAN infrastructure considerations and infrastructure build outs:

- Dedicated Telemedicine WAN circuits accommodating the payload transmission of NAIHS X-Ray DIACOM image files for Reads and Consults.
- Dedicated Telemedicine Routers.
- VLAN of LAN traffic at Service Units, Health Centers, and Health Stations.

The Albuquerque Area Indian Health Service

The Albuquerque Area IHS site transmits images to the Albuquerque Indian Health Center, ACL Hospital (X-ray images), Jemez Health Center (all images sent to PACS), Dulce Health Center (all images sent to PACS), Zuni Indian Hospital (all images sent to PACS), and Mescalero Indian Hospital (X-ray images). Albuquerque Area IHS utilizes and supports **7** televideo systems for supporting TeleBehavioral Health Consults.

Tucson Area Indian Health Service

The Tucson Indian Health Service CIO previously served as the CIO of the Navajo Area IHS and Director of Information Resource Management at the Phoenix Area IHS, working collaboratively with hospital and healthcare center staff in developing telehealth network infrastructure in support of connectivity to the Arizona Telemedicine Network. The Tucson IHS provided technical and administrative support for infrastructure development for telemedicine clinical services, distance learning, videoconferencing and modalities to include; radiology, dermatology, retinal screening, cardiology, and mental health.

The Arizona Telemedicine Program

The Arizona Telemedicine Program (ATP) was created in 1996 as a ground-breaking partnership between the Arizona State Legislature and the Arizona Health Sciences Center in Tucson. This 8-site pilot project has evolved into one of the largest and most successful comprehensive telemedicine programs in the world.

ATP has succeeded in creating partnerships among a wide variety of not-for-profit and for profit healthcare organizations and has created new interagency relationships within state government. Functioning as a "virtual corporation," the ATP is creating new paradigms for healthcare delivery. It is recognized as one of the premier programs at the UA College of Medicine and has received numerous awards at the national level for its research and innovations in telemedicine.

The economics of telemedicine are especially noteworthy:

- The Arizona Department of Corrections saved over $1 million by avoiding costly prisoner transports to regional medical centers.
- Over $100,000 has been saved by reducing the need for psychiatrists to travel to dozens of rural communities.
- Reduced air transports of patients injured in automobile accidents has saved hundreds of thousands of dollars.
- Expensive medical air transports of Native American patients have been drastically reduced.
- Radiology is available 24/7 in many rural communities, an unprecedented level of service.
- With the creation of Ultraclinics™, it now takes 4 hours instead of weeks for a woman in Arizona to receive a complete breast exam, from time of biopsy to consultation, with an oncologist. Men can receive the same turn around time for prostate exams. Additional disease categories will soon be implemented.

Over 275,000 Arizonans have received health care services by telemedicine. Quality of service is high and routinely accepted by both service providers and patients. Services are available in 60 subspecialties of medicine, surgery, pediatrics, psychiatry, radiology, pathology, and many others. Over 100 telephysicians and telenurses have provided services over the network.

Sangre de Cristo Community Health Partnership

The Sangre de Cristo Community Health Partnership (SDCCHP) manages and maintains two telehealth networks: One is the Substance Abuse and Mental Health Service Administration's Center for Substance Abuse Treatment (SAMHSA CSAT), Screening, Brief Intervention, Referral and Treatment (SBIRT) Project; the other is the NM Department of Health's Office of School and Adolescent Health (OSAH) for development, training and maintenance of 18 school-based health centers across the state.

The SAMHSA CSAT SBIRT network consists of 20 sites each equipped with videoconferencing capability over an IP network involving T-1 lines into each facility. The OSAH network is in its initial phase of implementing the **18** sites, and also involves T-1 lines into each facility.

Presbyterian Medical Services

The diversity of services delivered by Presbyterian Medical Services (PMS) includes primary medical, oral and behavioral health care; affordable access to pharmacy services; home care; hospice; senior center programs; homeless and school-based special population services; services for the developmentally challenged, including those with traumatic brain injury; and early childhood development services, including Early Head Start and Head Start. PMS currently operates 82 individual program sites in 38 community locations throughout New Mexico, serving the counties of San Juan, Taos, McKinley, Cibola, Catron, Socorro, Luna, Rio Arriba, Sandoval, Santa Fe, Torrance, Quay, Eddy, Lincoln, and Otero.

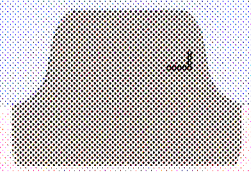
PMS has telemedicine (broadly referred to as telehealth, including telepsych) programs in progress and is actively expanding these services. It is currently interacts with Project Echo (for training and education of providers in treating Hepatitis C) and Project Reach (children's counseling). PMS is also partnering in providing Post Traumatic Stress Disorder (PTSD) assessment and referral services and is expanding investment in and commitment to telepsych services, in partnership with Value Options. In addition to external partners, PMS has developed significant in-house expertise in telehealth services offered between our internal sites. Besides the obvious benefit of being able to offer professional services to sites that would have previously gone without this expertise, PMS has found that one of the significant benefits of having an infrastructure that supports telehealth services is that it is able to monitor outcomes, supervise treatment and schedule follow-up remotely.

Holy Cross Hospital
Holy Cross Hospital (HCH) and its non-profit healthcare partners provide primary medical and emergency services, affordable access to pharmacy services; diabetes case management, prenatal care and infant health; child preventive care and case management for children with special healthcare needs; family health, and early childhood development services.

HCH and its partners are in the process of developing and expanding these services through the information technologies intended to meet the healthcare needs of residents in the most remote locations of our service region, which includes Taos, Rio Arriba, Colfax, Mora and Union Counties in New Mexico. We are currently working with:

- HCH Rural Health Clinic in Penasco to provide comprehensive primary health services for outlying areas of the service region
- Enchanted Circle Health Outreach for Kids to improve access to preventive care for children and case management for children with special healthcare needs
- First Born Program to improve prenatal care and infant health
- Collaborative Action for Taos County Health to create a single point of entry and establish a disease management continuum of care within the county
- Radiology Upgrade Project includes digitizing imaging in Radiology. By upgrading the hospital's radiology services, we will help physicians to diagnose and treat patients anywhere, especially if they travel to urban hospitals. Digital radiology images can be sent via the Internet and any physician can access a patient's prior radiology images stored in Holy Cross Hospital's databanks.

University of New Mexico Health Sciences Center Carrie Tingley Hospital.
The Pediatric Behavioral Medicine service has been providing telemedicine services across the state and into Arizona for 7 years. It has linked to hospitals, schools, clinics, and individual homes across the state as well as Indian Health Service in Chinlee, AZ. The program has experience using T1, videophone, and Webcam based technology and has one psychologist dedicated to managing the system and working with the CfTH.



TAG Project Management Plan

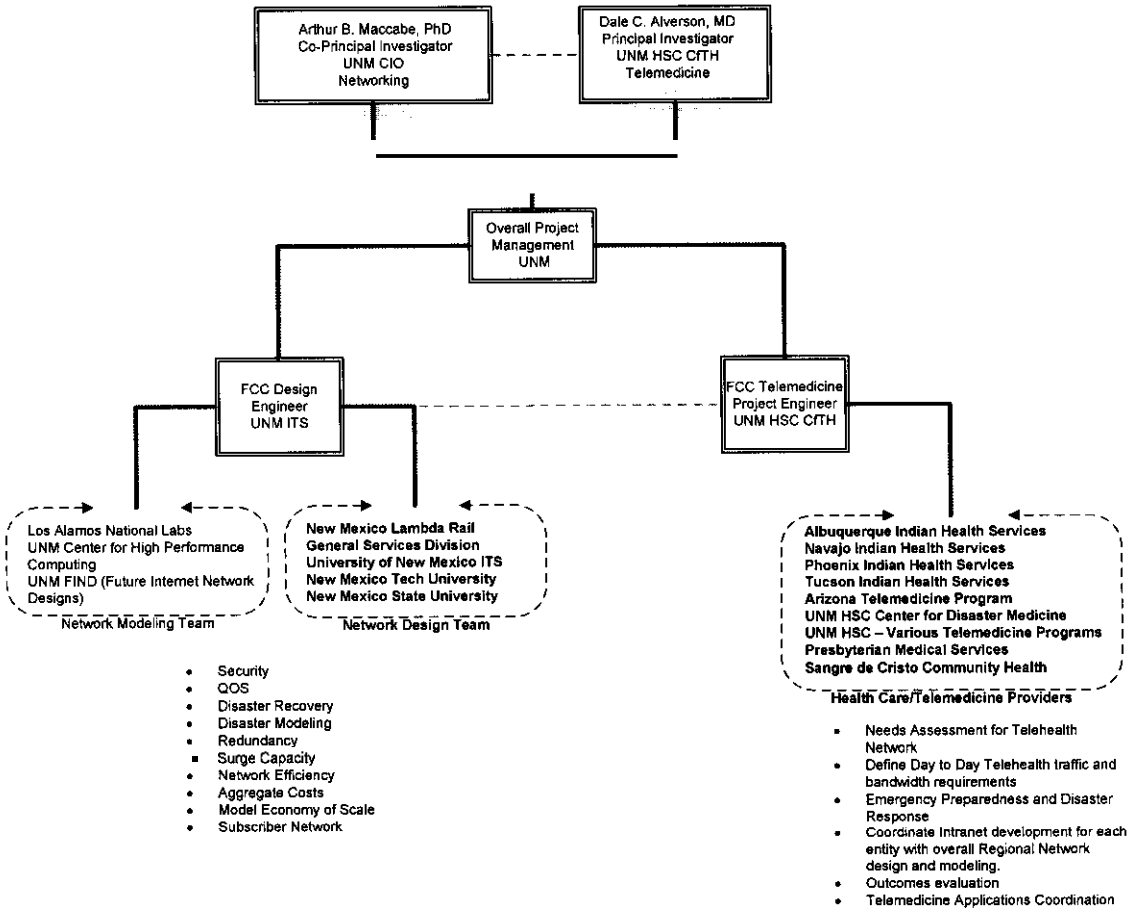
The Center for Telehealth & Cybermedicine Research (CfTH) will be the primary agency responsible for managing the FCC Pilot Program. Dale C. Alverson, MD, will be the principal investigator. Barney Maccabe, UNM CIO, will be the co-principal investigator.

The University of New Mexico will manage the financial responsibilities for the Pilot Program, ensure all documentation and forms under the normal rural healthcare program are properly submitted to the FCC, and implement standard grant management policies and procedures required by UNM.

The Center will coordinate efforts of the network design studies involving all parties and ensure that a detailed design is submitted on time. UNM Offices of the CIO will provide technical project management for statewide networking infrastructure components of the program and integration with current and planned statewide networking infrastructure initiatives. Upon completion of the design studies, the Center will ensure that detailed project plans and schedules are developed and implemented on time, reporting back to the FCC on project completion and milestones.

The CfTH currently acts as a coordinating center throughout the State of New Mexico and the southwest region for telemedicine activities and will continue to do so under this program. The Center's Telemedicine Project Engineer will coordinate with the network design studies group and network modeling team and provide a telemedicine needs assessment to both. The Center will also coordinate new and on going technical telemedicine needs with the implementation of new network infrastructure. Please see the FCC Pilot Program Project Management chart below.

FCC Pilot Program Project Management Plan



Specific Participant Project Management

UNM, NMSU, NMIMT
The universities and the State of New Mexico General Services Department will continue their existing partnership to provide project management and collaborative leadership to achieve the goals and objectives of the proposal. Their partnership has formal memoranda of understanding (MOU), and they work together to discuss, plan and implement statewide projects. Work plans are developed by members of the state and universities and are approved by a steering committee of the State and the Universities as well as the New Mexico Lambda Rail not-for-profit corporation. The work plan will be to connect rural areas to the nearest GigaPop enabling statewide as well as national network connections. Areas will be prioritized based on cost, network capability available, and relevance to the goals of the project.

The management of the New Mexico Lambda Rail Initiative will be done by an independent non-profit organization formed by the three New Mexico research universities. To encourage participation, a very cost-effective pricing strategy is being implemented that will cover membership fees and the operational costs for non-commercial traffic.

UNM Center for Disaster Medicine
The staff of the Center for Disaster Medicine will provide expert consultation to the project regarding the New Mexico emergency response structure and operations, federal requirements and guidelines for training and education of healthcare and public health professionals, and federal requirement and guidelines for communication and incident management during disasters.

In the event of a disaster or large scale emergency, CDM will participate with the NM Department of Health and other emergency management agencies in the provision of Just-in-Time training to health professional and emergency responders. This training will be augmented by the increased broadband capability of CDM funded by the Telehealth Access Grid project and will be integrated into the expanded network develop in New Mexico for rural telehealth.

Albuquerque, Navajo, Phoenix, and Tucson Areas Indian Health Service
In 2006, the IHS Albuquerque, Navajo, Phoenix, and Tucson Areas signed a regional Memorandum of Understanding (MOU) for collaboration activities related to telehealth. This MOU reinforces multiple years of regional partnership between the four IHS Areas in telemedicine project development. Noteworthy information-sharing and project planning has occurred through the regional collaboration within the Indian Health Service known as the IHS Southwest Telehealth Consortium. This Consortium will continue to provide project support and oversight for the regional IHS Area participation in the FCC Pilot Program. The Albuquerque Area Indian Health Service will fiscally represent the **4 IHS** Areas for this project.

Each respective IHS Area will also support its own regional telemedicine network and activities via the existing administrative and clinical infrastructure and leadership of those Areas. Previous regional IHS and Tribal experience working with the Universal Service Administration Corporation in support of the Navajo, Phoenix, and Tucson Areas infrastructure expansion and development will be applicable to this Pilot Project..

Navajo Area Office of Indian Health Service
The Navajo Area IHS is under United States IHS, which is under the parent organization Department of Health and Human Services (DHHS). The leadership component can be traced to the CIO of IHS, Dr. Theresa Cullen and the IHS Southwest Telehealth Consortium (Phoenix, Albuquerque, Tucson, and Navajo Area Offices). These leadership vessels meet routinely throughout the Fiscal year.

The project management will be largely the responsibility of LCDR Michael J. Belgarde with the brain trust of IHS Office of Information Technology (OIT), IHS Network Operations Security Center (NOSC), Arizona Telemedicine Program (ATP), and Federal Contractor Awardees. (See Appendix 1-8)

Tucson Area Indian Health Service
The Tucson Indian Health Service will provide technical and administrative oversight of current telehealth infrastructure and future FCC Rural Health Care Pilot Program for the Tucson Area IHS. Their previous experience in working with the USDA's Universal Service Administration in support of the Navajo, Phoenix, and Tucson Areas infrastructure expansion and development will be applicable to this Pilot Project. (See Appendix 1-23)

Albuquerque Area Indian Health Service
Albuquerque Area Indian Health Service will support its own regional telemedicine network and activities via the existing administrative and clinical infrastructure/leadership. Sustaining Internet2 access once established will be supported by IHS Technical staff up to the "edge" of the Indian Health Service Network. (See Appendix 1-2)

Arizona Telemedicine Program (ATP)
ATP has **a** well defined organizational structure with the Director, Co-Director, Medical Director, and Associate Directors at its helm.

With FCC Rural Health Pilot program funding, ATP will purchase the specified equipment (see budget and equipment spreadsheets for ATP) and deploy it to network core sites in Tucson, Phoenix and Flagstaff **as** well as selected remote sites most in need of upgraded WAN and firewall equipment. This is the first phase of a multi-year plan to upgrade the ATP network backbone to modem carrier level service capabilities, including the ability to encrypt private WAN transmissions and to transition away from the current ATM network core. ATP does not have sufficient funding resources to do the entire upgrade in the first year.

ATP personnel will be trained on Juniper routing and firewall hardware and software and will install and configure the network equipment. ATP personnel have extensive internetworking and network firewall experience and have the ability to transition to **a** new routing platform. ATP currently supports **a** multivendor network architecture and has achieved operational interoperability amongst Juniper, Cisco, Marconi, Riverstone, HP and others. Implementation of the core equipment would take approximately 90-120 days following the award of this FCC proposal. This would allow time for training, testing and cutover to the new core routing hardware. Implementation of the edge firewall/routing equipment would take approximately 180 days from the award date to complete for all locations. Additional time is needed for the edge equipment to allow for coordination of deployment with sites that will receive the upgraded equipment. ATP staff will implement the new core routing equipment. The network is currently, and will continue to be, pro-actively monitored on a 24x7 basis with automated notifications of outages

and problem conditions sent to on-call staff. ATP's existing network monitoring and configuration management software will work with the new core and edge network equipment.

In addition to the equipment requested in year **1,** ATP is seeking funding to cover the costs of leased lines for telemedicine networking that are not currently eligible for the USF program due to lack of rurality. A net cost reduction for leased line services will result for the ATP backbone and for some ATP sites that do not currently qualify for USF since they are not in a rural area, but are in some cases paying substantially more than the current USF standard rate for leased line services. ATP or its members are currently funding the leased lines for which FCC subsidy is requested. ATP will manage the implementation of any new leased line services that may be implemented as a replacement for existing services if a different carrier is awarded the contract through the USF bidding process. (See Appendix 1-27)

ATP Plans for Year 2

In year 2, ATP will purchase the specified equipment **(see** budget and equipment spreadsheets for ATP) and deploy to network core sites in Tucson, Phoenix and Flagstaff, as well as to selected remote sites that are most in need of upgraded WAN and firewall equipment. This is the second phase of a multiyear plan to upgrade the ATP network backbone to modern carrier level service capabilities and to transition away from the current ATM network core. ATP does not have sufficient funding resources to do the entire upgrade in the first year. Implementation of the core equipment would take approximately 60-90 days following the award of this FCC proposal in year 2. The year 2 core equipment is a modular add-on to the year 1 equipment providing ATP with the ability to aggregate leased line connections via the new core routing equipment vs. the current ATM layer 2 core network that now provides WAN aggregation for ATP. The equipment specified in year 2 will allow ATP to migrate most of its spoke leased line connections off of ATM in preparation for a complete migration off of the ATM network core in year **3.** Implementation of the T1 modules on the edge equipment acquired in year 1 will take approximately 180 days following the year 2 award. Additional time is needed for the edge equipment to allow for coordination and travel. ATP personnel will handle the installation of the T1 interfaces at the remote sites..

Sangre de Cristo Community Health Partnership

Sangre de Cristo Community Health Partnership (SDCCHP) has in place the professional staff and industry contacts to continue management of the current telehealth initiatives as well as any proposed expansion initiatives. **(See** Appendix 1-43)

Presbyterian Medical Services (PMS)

Since this Pilot Project is heavily focused on technical infrastructure, PMS's overall project will be managed by the Information Services (IS) Department, headed by their Chief Information Officer (CIO). Business and Clinical oversight will be provided by Vice President of Clinical Affairs, Director of Behavioral Health, and Director of Children's Services. Compliance oversight will be provided by the **PMS** Vice President and Corporate Council and by the Compliance Officer. PMS System Directors and Site Administrators will be involved at the detailed implementation phases of the project. **(See** Appendices 1-35).